

Department of Biochemistry



**Study Guide For
2nd Year MBBS**

**Sharif Medical & Dental College,
Lahore**



PREFACE

This curriculum is designed for medical undergraduates by collaborated effort of all subject specialists across the year to provide medical students of SM&DC a resource material to share important aspects of the curriculum designed by the university of Health Sciences, Lahore.

The main aim is to promote self-regulated and academic learning among students by empowering them to achieve their aims and objectives of medical education. The overarching curricular aspects of undergraduate competencies, assessment policies and names of curriculum coordinators are all included in this guidebook.

By means of careful arrangement amongst the primary subjects taught to first year MBBS, a resourceful alignment has been formatted for a conceptual understanding of these subjects whilst the provision of relevant clinical details ensures the necessary understanding of patient presentation and management.

SMDC aims to improve health indicators of the community and society at a large scale by training their students and doctors in preventive healthcare services and best health education through community outreach programs.

This study guide gives an overview of learning outcomes and objectives in relation to the course contents described. The assessment methodology used for the calculation of students' internal assessment is also provided. It has been prioritized that the entirety of the MBBS curriculum is designed in accordance with guidelines provided by the University of Health Sciences (UHS) and Pakistan Medical Commission (PMC). This is achieved by means of a combined and concentrated effort by of the institutional faculty.

Since curriculum is a living and a dynamic document, therefore it is suggested that it is to be updated and to be improved on yearly basis, using evidence generated through program evaluation and feedback from both students and faculty members. We hope that this humble effort of the contributing faculty will prove to be a guiding light for our dear students.

Regards.



Vision & Mission of UHS

Qualitative and Quantitative Revolution in Medical Education and Research through Evolution and thereby improve Health Care delivery to Populace.

UHS shall be innovative global center of excellence in learning and research, supporting a community of scholars and professionals committed to serving society, promoting the development of students to reach their true potential in becoming competent, ethical, caring, and inquiring health professionals for the benefit of the country and the wider world.

Mission of SMDC

Sharif Medical & Dental College is dedicated to best serve the nation through preservation and dissemination of advanced knowledge and educating the students by latest trends in learning and research reaching levels pars excellence.

The Institution is committed to provide standardized quality medical education to its students by inculcating professional knowledge, skills and responsibilities in them with the aim of:

- Preparing them as modern physicians having initiative to act as future leaders in their respective fields and becoming lifelong learners.
- Encouraging the spirit of critical thinking through research and publication.
- Building up an understanding of the ethical values compatible with our religion, culture and social norms.
- Developing a sense of being responsible citizens of the society possessing professional competence and instilling in them the values of hard work and dedication thus preparing them to be accountable to the stakeholders and the state.

The Institution is devoted to keep abreast its faculty with the latest trends in Medical Education encompassing teaching/learning methodologies, assessment tools, research opportunities and professionalism to facilitate their professional development, competencies and commitment towards continues learning.

Our patient-centered mission is achieved by outstanding medical care & services in professional practice with due emphasis and focus on our local health needs.

Our mission further elaborate upon establishing academic and research facilities in areas of local demand under global gold standards and leading advancement in research, education & patient care.

Vision of SMDC

To be recognized for the provision of a safe and functional environment conducive to collaborative teaching & learning, comfortable working atmosphere, and conducting world class research through professionalism and excellence.



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PLANNED TEACHING ACTIVITIES FOR 2nd YEAR MBBS

DEPARTMENT OF BIOCHEMISTRY

PMC has allocated 200 hours of teaching in the subject of Biochemistry for the MBBS course. In order to meet this requirement following teaching modules have been planned. The modules have been carefully designed to impart core knowledge of Biochemistry in a way that an undergraduate student can grasp the subject fully and is adequately prepared for examination in any university.

Lectures:

A total of 144 lectures are planned for the entire year in 36 weeks. The lectures will be conducted by the Professor, Associate and assistant professors. The lectures will be interactive and students should actively participate in them to clear their doubts. The students are required to take notes of the lectures and study the topic with the help of prescribed text books.

Practical classes:

The whole class of 100 students divided into 4 batches to conduct the practicals effectively and one batch perform practical per week. Practical will be conducted by demonstrators under an active supervision of senior instructors. Students are required to enter their work in their practical note books which comprises of the principle procedure observation and interpretations of the current practical and get them checked by the instructors regularly.

Tutorials:

The whole class of 100 students divided into 4 batches to conduct the tutorial effectively and one batch take tutorial in alternate week. Topics for the tutorial will be notified at least one week before the class. The instructors will be deputed for every batch on rotation basis. During this interactive session the students must clear their concepts regarding the topic by actively engaging with their respective teachers.

Small Group Discussion:

Case based learning classes will be conducted from time to time throughout the academic year. A clinical scenario will be discussed with students by dividing them in groups. A senior instructor will be facilitating the discussion in interactive session and students are required to generate the discussion amongst themselves in line with the learning objectives of the topic.

Presentations by the students:

Presentations of the ongoing topic will be conducted throughout the year periodically by the students so as to cover the topic of discussion precisely according to course work designed by UHS and emphasizing its clinical relevance and research relationship. Preferably topics will be allocated to the group of 3-4 students and they will present a very short presentation of 10-15 minutes related to the topic and discuss all the relevant important aspects followed by Q&A session after it.



TRAINING PROGRAM FOR LECTURERS DEPARTMENT OF BIOCHEMISTRY 2ND YEAR MBBS

General

- Biochemistry is the dynamic, exciting science in which chemistry is applied to the study of the atoms and molecules which comprise living organisms. This includes organic molecules and their chemical reactions. It has revolutionized our understanding of and provides a backbone to modern medicine.
- Biochemistry Department at SM&DC has a unique approach to the biochemical sciences that cultivates critical thinking as well as depth of knowledge by exposing its students to the full spectrum of modern biochemistry. The comprehensive teaching and assessment plan is strategically designed according to the UHS and PMC syllabi and guidelines to achieve maximum results.
- The strength of Biochemistry Department is its conducive environment and committed staff.
- The vibrant teaching staff is highly qualified with post graduates degrees and certifications along with vast teaching experience. The department's aim is establishment of research culture and encouragement of student participation in it.
- Biochemistry department has a well-equipped laboratory and is managed by qualified and experienced technical staff.

METABOLISM OF CARBOHYDRATES

Sr. No.	Title of Lecture	Instructor
1	Introduction and reactions of glycolysis	Dr. Hassan Jamil
2	TCA	
3	Gluconeogenesis	
4	Glycogen Metabolism	
5	Metabolism of Monosaccharides and disaccharides	
6	Pentose Phosphate pathway and uses of NADPH	
7	Glycosaminoglycans, proteoglycans and glycol proteins	

METABOLISM OF LIPIDS

Sr. No.	Title of Lecture	Instructor
1	Structure of fatty acids	Dr. Gul-e- Raana
2	Steps involved in Denovo Synthesis of fatty acid	
3	Mobilization of store fats and oxidation of fatty acids	
4	Ketone bodies	
5	Structure of phospholipids	
6	Phospholipids synthesis	
7	Degradation of phospholipids	



8	Overview of structure synthesis and degradation of glycosphingolipids	
9	Prostaglandins and related compounds	
10	Structure, synthesis and degradation of cholesterols	
11	Bile acids and bile salts and their clinical relevance	
	Plasma Lipoproteins composition metabolism regulation and classification of HDL, LDL, VLDL and its relation to cardiac disease	

METABOLISM OF PROTEINS AND AMINO ACIDS

Sr. No.	Title of Lecture	Instructor
1	Nitrogen balance	Dr. Gul-e-Raana
2	Digestion and absorption of dietary proteins	
3	Transport and removal of nitrogen from amino acids	
4	Urea cycle and its clinical significance	
5	Metabolism of ammonia and hyperammonemia	
6	Catabolism and anabolism of amino acids	
7	Metabolic defect in amino acids metabolism like phenylketonuria, maple syrup disease, albinism, homocystinuria and alkaptonria	

BIOENERGETICS AND BIOLOGIC OXIDATION

Sr. No.	Title of Lecture	Instructor
1	Exergonic and endergonic	Dr. Samra Hafeez
2	Electron transport chain	
3	Oxidative phosphorylation	
4	Chemiosmotic hypothesis	
5	Uncouplers and inhibitors of etc	

WATER & ELECTROLYTE METABOLISM AND REGULATION OF ACID-BASE BALANCE

Sr. No.	Title of Lecture	Instructor
1	PH and its clinical importance	Dr. Hassan
2	Role of body buffers in regulation of acid base balance	
3	Acid-base balance of human body	
4	Acidosis and alkalosis	
5	Renal regulation of PH and role of kidney	



BIOCHEMICAL GENETICS (INFORMATIONAL FLOW IN THE CELL)

Sr. No.	Title of Lecture	Instructor
1	Structure of DNA	Dr. Samra Hafeez
2	Steps in prokaryotic synthesis	
3	Replication in eukaryotic DNA	
4	DNA repair and its clinical significance	
5	RNA and its types	
6	Transcription of prokaryotic and eukaryotic genes	
7	Post transcriptional modification	
8	Protein synthesis steps	
9	Co and posttranslational modifications	
10	Regulation of gene expression	
11	Biotechnology and its role in human diseases	

METABOLISM OF NUCLEOTIDES

Sr. No.	Title of Lecture	Instructor
1	Structure of nucleotides	Dr. Gul-e-Raana
2	Synthesis and degradation of purine nucleotides	
3	Diseases associated with purines degradation	
4	Pyrimidine synthesis and degradation and its clinical relevance	

BIOCHEMISTRY OF DIGESTIVE TRACT

Sr. No.	Title of Lecture	Instructor
1	Digestion and absorption of macro molecules	Dr. Anam
2	Gastric juice and its clinical significance	
3	Intestinal juices and their biomedical importance	
4	Pancreatic secretion composition	
5	Achlorhydria	
6	Gastro intestinal hormone	

INTEGRATION AND REGULATION OF METABOLIC PATHWAYS

Sr. No.	Title of Lecture	Instructor
1	Fed fast cycle and starvation	Dr. Hassan
2	Introduction and integration of anabolic and catabolic pathways	
3	Role of liver, heart, brain, skeletal muscles and adipose tissues in regulation of blood sugar level	
4	Inborn errors of metabolism	
5	Regulation of blood sugar level by insulin and glucagon	



BIOCHEMISTRY OF ENDOCRINE SYSTEM

Sr. No.	Title of Lecture	Instructor
1	Classification of hormones	Dr. Samra Hafeez
2	Mechanism of action of each class of hormones	
3	Signal transduction pathways and G-proteins	
4	Pituitary and hypothalamic hormones structure synthesis mechanism of action and their biological role	
5	Disorder associated with growth hormone, thyroid hormone adrenal hormone and posterior pituitary hormones	
6	Calcium regulating hormones	

METABOLISM OF XENOBIOTICS

Sr. No.	Title of Lecture	Instructor
1	Classes of xenobiotics and their medical relevance	Dr. Anam
2	Phase 2 metabolism of xenobiotics	
3	Role of xenobiotics in enzyme induction and in phase 1 metabolism	

LIST OF LECTURES IN THE SUBJECT OF BIOCHEMISTRY AND THEIR LEARNING OBJECTIVES

At the end of the course, the students should be able to discuss and describe following topics

S. No.	Title of Lectures with Learning Objectives
1	<p>METABOLISM OF CARBOHYDRATES</p> <p>a) Glycolysis</p> <ol style="list-style-type: none"> i. Differentiate reactions of aerobic and anaerobic glycolysis occurring in RBCs and other tissues ii. Discuss biomedical significance and energy yield of aerobic and anaerobic glycolysis and its significance and substrate-level phosphorylation iii. Summarize regulation of glycolytic pathway iv. Outline the metabolic fates of pyruvate v. Explain lactic acidosis; genetic deficiency of pyruvate kinase and pyruvate dehydrogenase <p>b) Tricarboxylic acid (TCA) cycle</p> <ol style="list-style-type: none"> i. Draw reactions of TCA cycle and their regulation along with energy yield. ii. Discuss importance of TCA cycle and its amphibolic role <p>c) Gluconeogenesis</p> <ol style="list-style-type: none"> i. Write reactions of gluconeogenesis using pyruvate and glycerol as precursors and regulation of gluconeogenesis. ii. Generalize the important gluconeogenic precursors: Entrance of amino acids, intermediates of TCA cycle, glycerol, and other compounds as gluconeogenic precursors. iii. Biomedical significance of gluconeogenesis: Role of gluconeogenesis in plasma glucose level regulation, and the Cori cycle, and glucose-alanine cycle. <p>d) Glycogen metabolism</p> <ol style="list-style-type: none"> i. Demonstrate synthesis and importance of UDP glucose ii. Compare reactions of glycogenesis and glycogenolysis iii. Review the regulation of glycogenic synthase and glycogen phosphorylase iv. Analyze importance of allosteric regulation of glycogen phosphorylase 'a' (a plasma glucose sensor) by plasma glucose v. Summarize disorders of glycogen metabolism (glycogen storage diseases) <p>e) The hexose monophosphate pathway and other pathways of hexose metabolism</p> <ol style="list-style-type: none"> i. Describe hexose monophosphate (HMP) pathway: Reactions of oxidative and non-oxidative phases of HMP pathway, importance of HMP pathway along with uses of NADPH, and glucose 6-phosphate dehydrogenase deficiency. ii. Explain reactions of uronic acid pathway along with its biologic

	<p>importance.</p> <p>iii. Metabolism of fructose: Metabolic fate of fructose in human body, sorbitol metabolism along with effect of hyperglycemia on sorbitol metabolism, essential fructosuria and hereditary fructose intolerance.</p> <p>iv. Metabolism of galactose: Metabolic fate of galactose in body and synthesis of lactose: and disorders of galactose metabolism (galactokinase deficiency and classic galactosemia).</p> <p>v) Metabolism of ethanol</p> <p>f) Regulation of blood glucose level</p> <p>i. Justify regulation of plasma glucose hormonally (insulin, glucagon, growth hormone, epinephrine, and cortisol) and non-hormonally, and the role of various metabolic pathways in blood glucose level regulation</p> <p>ii. Differentiate between hypoglycemia and hyperglycemia: An overview of hypoglycemia and hyperglycemia, their important causes, and clinical manifestations.</p> <p>iii. Describe diabetes mellitus: Types of diabetes mellitus along with its clinical manifestations, metabolic changes in type 1 and type 2 diabetes mellitus, and diagnosis of diabetes mellitus.</p> <p>iv. Estimation of glucose in blood and other biological fluids and oral glucose tolerance test (OGTT).</p>
2	<p>METABOLISM OF LIPIDS</p> <p>a) Describe de novo Synthesis of fatty acid synthesis: Production of cytosolic acetyl CoA, fatty acid synthase multienzyme complex, reactions of cytosolic fatty acid synthesis, elongation of fatty acid chain, synthesis of polyunsaturated fatty acid, and regulation of fatty acid synthesis.</p> <p>b) Draw synthesis and storage of triacylglycerols in body.</p> <p>c) Explain mobilization of stored triacylglycerols along with its regulation</p> <p>d) Review oxidation of fatty acids: Activation of fatty acid, translocation of fatty acyl CoA into mitochondrial matrix, reactions of β-oxidation of saturated and unsaturated fatty acids, energy yield of β-oxidation, fate of acetyl CoA, and other types of fatty acid oxidation (alpha-oxidation, omega-oxidation, and oxidation of odd-carbon fatty acids).</p> <p>e) Illustrate synthesis and utilization of ketone bodies: Reactions of hepatic ketogenesis and utilization of ketone bodies by extrahepatic tissues.</p> <p>f) Define ketoacidosis and regulation of ketogenesis.</p> <p>g) Tabulate synthesis of eicosanoids along with its regulation and biologic functions of eicosanoids.</p> <p>h) Metabolism of phospholipids and sphingolipids: Synthesis of phospholipids (phosphatidylcholine and phosphatidylethanolamine), synthesis of glycerol ether phospholipids (cardiolipin and platelet activating factor), degradation of phospholipids, deficiency of lung</p>

	<p>surfactant, metabolism of glycolipids, biosynthesis of ceramine, sphingomyelin, and gangliosides, and degradation of sphingolipids along with sphingolipidoses.</p> <p>i) Describe cholesterol metabolism: Reactions and regulation of cholesterol biosynthesis and fate and functions of cholesterol in body.</p> <p>j) Discuss biosynthesis and fate of bile acids and their significance in health and disease.</p> <p>k) Classify plasma lipoproteins: Synthesis, transport, and fate of chylomicrons, VLDL, IDL, LDL, and HDL; disorders associated with impairment of lipoprotein metabolism, and atherogenic effect of oxidized LDL.</p> <p>l) Biochemical defects leading to fatty liver</p>
3	<p>METABOLISM OF PROTEINS AND AMINO ACIDS</p> <p>a) Describe an overview of protein turnover in human body; nitrogen balance (positive and negative).</p> <p>b) Illustrate how Inter-organ amino acid exchange in normal post-absorptive state</p> <p>c) Explain degradation of amino acids; removal of nitrogen from amino acids by. Transamination and deamination; sources of ammonia in body; ammonia toxicity; fate of ammonia in body, reactions and regulation of the urea cycle along with metabolic disorders of the urea cycle.</p> <p>d) Write overview of amphibolic intermediates formed from the carbon skeleton of amino acids.</p> <p>e) Differentiate between glucogenic and ketogenic amino acids; metabolism of individual amino acids like glycine, cysteine, arginine, proline, phenylalanine, tyrosine, histidine, tryptophan, and methionine; causes and salient features of important metabolic defects in amino acid metabolism like phenylketonuria, maple syrup urine disease (MSUD), histidinemia, alkaptonuria, cystathioninuria, homocystinuria, hyperprolinemia, cystinuria, cystinosis, tyrosinemia and albinism.</p> <p>f) Outline metabolism of epinephrine and norepinephrine, creatine, creatinine, histamine, gamma-aminobutyrate, serotonin, melatonin, and melanin.</p>
4	<p>BIOENERGETICS AND BIOLOGIC OXIDATION</p> <p>a) Discuss endergonic and exergonic reactions, free energy, free energy Change, ATP and other compounds as carriers of energy</p> <p>b) Explain electron transport chain: Components and organization of electron transport chain (ETC)</p> <p>c) Describe reactions of electron transport chain, redox potential, methods of electron transfer among the components of electron transport chain, and energy release during electron transport</p>

	<p>d) Review oxidative phosphorylation: ATP synthesis in ETC, inhibitors and uncouplers of oxidative phosphorylation, and chemiosmotic hypothesis of oxidative phosphorylation.</p>
5	<p>WATER & ELECTROLYTE METABOLISM AND REGULATION OF ACID-BASE BALANCE</p> <p>a) Discuss biochemical mechanisms to regulate water and electrolyte balance in body: Fluid compartments of the body; gain and loss of body water; regulation of body water balance, effect of pure water deprivation, water excess or water intoxication; and electrolytes of body fluids (sodium, potassium, magnesium and chloride).</p> <p>b) Explain body buffer systems, role of lung and kidney in maintenance of acid-base balance.</p> <p>c) Compare acid-base disturbance in the body like respiratory acidosis, metabolic acidosis (lactic acidosis and ketoacidosis); respiratory and metabolic, and concept of anion gap, base excess, and base deficit.</p> <p>d) Clinical interpretation of laboratory report of arterial blood gases.</p>
6	<p>BIOCHEMICAL GENETICS (INFORMATIONAL FLOW IN THE CELL)</p> <p>a) Explain the structural basis of cellular information</p> <p>b) Define organization of DNA in genome; chromosomes, Karyotyping, nucleosome, introns and exon .</p> <p>c) Discuss replication of DNA: Reactions of DNA replication in eukaryotes and prokaryotes; types of damage to DNA and DNA repair; mutations and cancers</p> <p>d) Explain Transcription (DNA-dependent RNA synthesis): Steps in the transcription of eukaryotic and prokaryotic genes; post-transcriptional modifications (processing) of RNA; reverse transcription in retroviruses and its relation to cancers and AIDS.</p> <p>e) Elaborate translation (protein synthesis): The genetic code; components required for protein synthesis, composition of eukaryotic and prokaryotic ribosomes; steps of protein synthesis; post-translational modifications of polypeptide chains:protein targeting.</p> <p>f) Compare regulation of gene expression in prokaryotes and eukaryotes and gene amplification.</p> <p>g) Elaborate molecular biology techniques: Basic information and biomedical importance of molecular biology techniques; DNA isolation; recombinant DNA technology; DNA cloning; polymerase chain reaction; hybridization; blotting techniques.</p> <p>h) Describe oncogenes and their role in carcinogenesis; mechanisms of activation of proto-oncogenes; mechanism of action of oncogenes; tumor suppressor genes and oncogenic viruses.</p> <p>i) Summarize genetic basis of disease and important tumor markers.</p> <p>j) Important tumor markers and their clinical significance</p>

	(Carcinoembryonic Antigen, Alpha fetoprotein, human chorionic gonadotropin, calcitonin and prostatic acid phosphatase).
7	<p>METABOLISM OF NUCLEOTIDES</p> <p>a) Explain de novo Synthesis of purines and pyrimidines; the salvage pathways of nucleotide synthesis; degradation of purine and pyrimidine nucleotides</p> <p>b) Discuss disorders associated with purine nucleotide metabolism like adenosine deaminase deficiency, gout, purine nucleoside phosphorylase deficiency.</p> <p>c) Write down natural and synthetic derivatives of purines and pyrimidines and their role in health and disease.</p>
8	<p>BIOCHEMISTRY OF DIGESTIVE TRACT</p> <p>a) Discuss introduction, chemical composition, and secretion and regulation of various digestive juices of GIT such as saliva, gastric juice & HCl, pancreatic juice, bile, and succus entericus</p> <p>b) Describe hydrolysis (digestion) of carbohydrates, lipids, proteins, and nucleic acids in gastrointestinal tract</p> <p>c) Explain absorption of carbohydrates, lipids, and amino acids</p> <p>d) Analyze disease states associated with GIT disorders like achlorhydria, peptic ulcers, lactose intolerance, cholelithiasis and pernicious anemia, cystic fibrosis and celiac disease.</p> <p>e) Elaborate the site of synthesis and major actions of gastrointestinal hormones like gastrin, cholecystokinin (CCK), secretin, gastric inhibitory peptide (GIP), vasoactive intestinal polypeptide (VIP), motilin, enkephalins, substance P, neurotensin, and enteroglucagon</p>
9	<p>INTEGRATION AND REGULATION OF METABOLIC PATHWAYS</p> <p>a) Fed-fast cycle and starvation.</p> <p>b) Summarize basic concepts of intermediary metabolism, introduction of anabolic and catabolic pathways</p> <p>c) Generalized overview of regulation and integration of various metabolic pathways (role of liver, heart, brain, skeletal muscle and adipose tissue) and overview of metabolic diseases including inborn errors of metabolism</p>
10	<p>BIOCHEMISTRY OF ENDOCRINE SYSTEM</p> <p>a) Summarize an overview of endocrine system; classification of hormones; mechanisms of action each class of hormone; general characteristics of various types of hormone receptors; types and actions various kinds of G-proteins in mediating the actions of hormones; signal transduction pathways of various hormones; types and role of various kinds of second messengers</p> <p>b) Review pituitary and hypothalamic hormones: Structure, synthesis, mechanisms of action, biologic actions of all hypothalamic and pituitary hormones; disorders associated with hyper- and hypo-activities of these</p>

	<p>hormones such as growth hormone deficiency (dwarfism), gigantism, acromegaly, Cushing's syndrome, Addison's disease, diabetes insipidus, and the inappropriate secretion of ADH (SIADH).</p> <p>c) Describe the structure, biosynthesis, and secretion, transport, mechanism of action, biologic role and metabolism of thyroid hormones; regulation of thyroid gland activity; pathologic conditions associated with altered thyroid function like goiter, hypothyroidism, hyperthyroidism, Graves' disease.</p> <p>d) Outline Calcium regulating hormones. Discuss structure, synthesis, secretion, transport, mechanism of action, and biologic actions of parathyroid hormone; disorders associated with hyper- and hypo-activities of these hormones like; role of parathyroid hormone, calcitriol, and calcitonin in calcium homeostasis; hypoparathyroidism, hyperparathyroidism (primary, secondary, and tertiary), pseudohypoparathyroidism, rickets, and osteomalacia.</p> <p>e) Describe structure, biosynthesis, secretion, transport, regulation, catabolism, mechanisms of action and biologic effects of adrenal cortical hormones; disorders associated with hyper- and hypo-activities of these hormones like Cushing's syndrome, secondary adrenal deficiency, Addison's disease, primary aldosteronism and secondary aldosteronism.</p> <p>f) Review structure, biosynthesis, transport, release, mechanisms of action, regulation, biologic effects, and catabolism of the adrenal medullary hormones; and associated disorders like pheochromocytoma</p> <p>g) Explain biosynthesis/control, mechanisms of action, and biologic actions of male and female gonadal hormones; disorders associated with hypergonadism and hypogonadism in males and females.</p> <p>h) Describe structure, synthesis, secretion, transport, mechanisms of action, catabolism and biologic actions of pancreatic hormones (insulin, glucagon, somatostatin and pancreatic polypeptide) disorders associated with hyper- and hypo-activities of these hormones like; pathophysiology of insulin deficiency and diabetes mellitus, regulation of insulin secretion; insulin receptor; structure and biologic functions of somatostatin and pancreatic polypeptide</p> <p>i) Write site of synthesis and major actions of gastrointestinal hormones like gastrin, cholecystikinin (CCK), secretin, gastric inhibitory peptide (GIP), vasoactive intestinal polypeptide (VIP), motilin, enkephalins, substance P, neurotensin, and enteroglucagon.</p>
11	<p>METABOLISM OF XENOBIOTICS</p> <p>a) Define and explain the main classes of xenobiotics of medical relevance; their phases of metabolism and clinical significance (Cytochrome P450: Cytochrome P450 hydroxylase cycle in microsomes; role of cytochrome P450 in phase I metabolism of xenobiotics; induction of cytochrome P450)</p> <p>b) What are Phase II metabolism of xenobiotics; types of phase II reactions;</p> <p>c) Explain responses to xenobiotics including pharmacologic, toxic, immunologic and carcinogenic effects</p>

LIST OF PRACTICAL FOR 2nd YEAR MBBS

Sr. No.	Topic	Practical
1	Instrumentation in clinical biochemistry	<ul style="list-style-type: none"> • pH Meter • Centrifugation and centrifuge machine • Chromatography • Electrophoresis • Flame photometry • Spectrophotometer • Pipettes
2	Estimation of Lipid Profile	<ul style="list-style-type: none"> • Tests to determine the concentration of total serum Cholesterol, • Serum triacylglycerol • HDL Cholesterol • VLDL and LDL Cholesterol
2	Estimation of Blood Chemistry	<ul style="list-style-type: none"> • Collection and preservation of blood samples • Determination of oral glucose tolerance test and glucose challenge test. • Tests to determine the blood glucose level by oxides method
3	Estimation of total plasma proteins	<ul style="list-style-type: none"> • Tests to determine the concentration of total proteins in plasma • Tests to determine the concentration of total albumin in plasma
4	Renal function test	<ul style="list-style-type: none"> • Determination of plasma uric acid by different methods • Enzymatic (uricase) method • Phosphotungstic acid method • Estimation of blood urea • Estimation of Serum Creatinine • Determination of Creatinine clearance
5	Estimation of serum calcium	<ul style="list-style-type: none"> • Determination of serum calcium levels.
7	Liver function test	<ul style="list-style-type: none"> • Determination of activities of Alanine Aminotransferase (ALT/SGPT) • Estimation of serum Aspartate Transaminase AST / SGOT • Estimation of alkaline phosphatase in plasma. • Estimation of plasma bilirubin
8	Other Blood Test	<ul style="list-style-type: none"> • Estimation of serum Amylase • Determination of serum Sodium, Potassium and chloride levels
	Cardiac Enzymes	<ul style="list-style-type: none"> • Estimation of Serum Creatine kinase • Estimation of Serum LDH

FORMATIVE ASSESSMENT (At the conclusion of each topic)

Topic	No Of Test/Tests	Marks	Mode of evaluation
Water & electrolyte + Acid base balance	1	50	Written /viva
GIT	1	50	Written /viva
Metabolism of Carbohydrates	3	100	Written + viva + OSPE
Metabolism of Lipids	3	100	Written + viva + OSPE
Metabolism of Proteins	3	100	Written + viva + OSPE
Metabolism of Nucleotide	3	50	Written /viva
Integration	3	50	Written (MCQs & SAQs)
Bioenergetics & Biological oxidation	1	50	Written (MCQs & SAQs)
Endocrinology	1	50	Written (MCQs & SAQs)
Xenobiotics	1	50	Written /viva
Cancer biology & Aging	1	25	Written (MCQs & SAQs)
Replication, transcription & DNA damage & repair	2	25	Written (MCQs & SAQs)



STAFF CONTACTS

Sr. No	Name	Email Address
1	Prof. Dr. Gul-e-Raana	guleraana60@gmail.com
2	Prof. Dr. Samra Hafeez	dr.samraisrar1993@gmail.com
3	Dr. Hassan Jameel	biohassan86@gmail.com
4	Dr. Anam Rehman	anamrana492@gmail.com
5	Dr. Unaiza Hassan	unaizahassan6@hotmail.com
6	Dr. Momena Zia	momenazia@gmail.com



PRESCRIBED TEXT BOOKS & REFERENCES

RECOMMENDED BOOKS

- Lippincott's Illustrated Reviews : Biochemistry by Harvey R and Ferrier D, Latest Ed, published by Lippincott Williams & Wilkins
- Harper's Illustrated Biochemistry by Murraray RK, Granner DK and Rodwell VW, Latest Ed, McGraw Hill
- Marks' Basic Medical Biochemistry – A Clinical Approach, by smith C, Marks AD, and Lieberman M. Latest Ed. Published by Lippincott Williams & Wilkins
- An introduction to practical Biochemistry by D.T. Plurnor.

REFERENCE BOOKS

- Textbook of Biochemistry 'with Clinical Correlations by Devlin TM, latest edition, published by Wiley-Liss
- Biochemistry by Berg JM, Tymoczko JL, and Stryer L, latest edition, published by W.H. Freeman and Company
- Clinical Chemistry and Metabolic Medicine by Martin A. Crook, latest edition, Edward Arnold (Publishers) Ltd
- Lehninger Principles of Biochemistry by David L Nelson and Michael M. Cox
- Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.
- Fundamentals of Biochemistry Life at Molecular Level by Donald Voet, Judith G Voet and Charlotte W. Pratt

**Head of Department
Prof.Dr.Gul-e-Raana**